January 4, 2011

To:	GSFC/Scott Braun	Project Scientist for TRMM
	GSFC/Robert Cahalan	Project Scientist for SORCE
	GSFC/Anne Douglass	Project Scientist for Aura
	GSFC/Marc Imhoff	Project Scientist for Terra
	GSFC/Elizabeth Middleton	Project Scientist for EO-1
	GSFC/Claire Parkinson	Project Scientist for Aqua
	JPL/Lee-Lueng Fu	Project Scientist for Jason-1& OSTM
	JPL/Ernesto Rodriquez	Project Scientist for QuikSCAT
	JPL/Graeme Stephens	Mission PI for CloudSat
	JPL/Michael M Watkins	Project Scientist for GRACE
	JPL/Deborah Vane	Project Scientist for CloudSat
	LaRC/Charles Trepte	Project Scientist for CALIPSO
	LaRC/David Winker	Mission PI for CALIPSO
	Laboratory for Atmospheric & Space Physics/Tom Woods	Mission PI for SORCE
	University of Texas/ Byron Tapley	Mission PI for GRACE
CC:	GSFC/E. Ketchum	ESM Program Office Director
	LaRC/F. Peri	ESSP Program Office Director

From: NASA HQ/DK/ M. Freilich/ Director, Earth Science Division

Subject: Call for Proposals – Senior Review 2011 and the Mission Extension for the Earth Science operating missions

The NASA Earth Science Division (ESD) of the Science Mission Directorate (SMD) is supporting several Earth observing missions that are, or soon will be, operating beyond their prime mission lifetimes. Extended operations and associated data production activities require a significant fraction of the ESD annual budget. NASA and the ESD thus periodically evaluate the allocation of Mission Operation and Data Analysis (MO&DA) funds with the aim of maximizing the missions' contributions to NASA's and the nation's goals. This periodic NASA evaluation process for missions in extended operations is known as the "Senior Review."

ESD will conduct the next Senior Review during the period March-June 2011, beginning with extended proposal submissions early in March, continuing with NASA evaluations including panel meetings during the weeks of April 11 and May 2, 2011, and culminating in extended mission decision announcements in August. This letter describes the objectives and process for the review, contains instructions for the preparation and submission of proposals, and provides initial guidelines for in-person presentations to the Science review panel.

The following twelve missions (in alphabetical order) are invited to propose to the 2011 Senior Review: Aqua, Aura, CALIPSO, CloudSat, EO-1, GRACE, Jason-1, OSTM, QuikSCAT, SORCE, Terra and TRMM. Performance factors are to include quality and demonstrated/anticipated scientific utility of the mission datasets, contributions to national objectives, technical status and budget efficiency.

The Senior Review:

The objective of the ESD Senior Review is to identify those missions beyond their prime mission lifetime whose continued operation contributes cost-effectively to both NASA's goals and the nation's operational needs; and (2) identify appropriate funding levels for those missions recommended for extension. While a mission's contribution to NASA's research science objectives is the primary evaluation criterion for mission extension, the ESD 2011 Senior Review explicitly acknowledges (1) the importance of long term data sets and overall data continuity for Earth science research; and (2) the direct contributions of mission data to national objectives, such as the routine use of near-real-time products from NASA ***research*** missions for applied and operational purposes by U.S. public or private organizations.

Each mission that is invited to this Senior Review will submit a proposal outlining how their activities over the period for the review (FY12-15) will benefit the Earth Science objectives described in the 2010 Science Plan for NASA's Science Mission Directorate (the *SMD Science Plan*). Each proposal will contain descriptions of the project's proposed science data analysis activities, recent accomplishments, technical status relating to the ability to deliver the proposed datasets, contributions to national objectives for Earth system monitoring, prediction and response, and a high level budget for the proposed activities.

The Senior Review panels (described in more detail below) will be formed by ESD to evaluate these proposals in March-May 2011. Their evaluations will be documented in reports to ESD. ESD will use the panels' findings, rankings and conclusions as inputs to rebalancing mission allocations. Actions may include maintaining the status quo, authorizing the mission to pass from prime to extended operations phase, restructuring the project including changes to the Level 1 requirements, or deciding to terminate an ongoing science mission.

The Senior Review Panels:

The Senior Review is composed of three panels: the Science Panel, Technical & Cost Panel, and National Interests Panel. The Science Panel is the primary panel. It will be an independent analysis group with sole responsibility to evaluate the scientific merit of each mission with respect to NASA's Earth science strategic plans and objectives. The Science Panel evaluations will be supplemented by the Technical & Cost and the National Interests panels. The findings of these 2 panels will be briefed to the Science Panel, and used by the Science Panel to develop its findings and overarching report. The Science Panel will be drawn from recognized expert members of the Earth Science research community.

The Technical & Cost Panel will assess the health and viability of the operating satellites and the proposed mission operations and data analysis costs and approaches. The Technical & Cost Panel will be drawn from technical experts from within and outside NASA.

The National Interests Panel will assess the utility and applicability of the mission's data products to satisfy national objectives by public (non-NASA) and private organizations. The National Interests Panel will be drawn from users of NASA research data for applied and operational purposes, including federal agencies, associations, non-governmental organizations and state/local/tribal agencies.

Instructions to the Senior Review Panels/Review Criteria:

NASA HQ will provide the following instructions to the Technical & Cost Panel:
The Technical and Cost Subpanel will be asked to assess the proposal's performance and reliability projections for the satellite and instrument(s), the mission operations implementation plan, the planned generation and delivery of the core data products, and the likelihood of accomplishment within the proposed cost. The evaluation will consider factors including the status of consumables and predicted utilization; spacecraft and instrument status, performance degradation, and failure risk; the proposed mission operations approach for the effective and safe management of an aging satellite; and mission and data management. Strategies to preserve the health of the hardware, to mitigate performance degradation and failures, to manage on-orbit consumables, and to ensure the continued performance and reliability of the ground systems will be assessed. The adequacy and efficiency of the cost plan will also be a factor in this evaluation. The evaluation will result in narrative text as well as a risk rating for the feasibility of the extended mission implementation.

NASA HQ will provide the following instructions to the National Interests Panel:
The National Interests Panel will be asked to evaluate the contributions of the core standard data products to applied and operational uses by public and private organizations (i.e. non-research purposes). National interests will include activities at state, tribal, regional, national and international levels. The evaluation will assess to what degree the mission has and will provide applied and operational benefits and utility to the nation. The evaluation will result in narrative text as well as a utility rating (Very High, High, Some, Minimal) for a mission's products or group of products, considering such factors as intrinsic value, frequency of use and latency. The panel will consider the adequacy and robustness of the mission's approach to data product for application and operational uses, through both on-going examples and future plans for an extended mission.

NASA HQ will provide the following instructions to the Senior Review Science Panel:

(1) In the context of the ESD science goals, objectives and research focus areas described in the 2010 SMD Science Plan, evaluate and rank the scientific merits of the proposed returns from each mission during FY2012 and FY2013. Factors to consider are intrinsic value and quality of the datasets, and promise for future scientific impact.

(2) Review the overall data products inventory for all missions under review, identifying possibly redundant or complementary products not noted by the individual mission proposals, and search for synergies not realized.

(3) Using input from the other panels, assess as secondary evaluation criteria the cost efficiency, non-research utility, and potential science merit impact due to probable technical status changes or performance degradation.

(4) Drawing on (1) - (3), provide science-based findings for the ESD extended missions for FY2012 and FY2013, including specifically:
- Continuation of projects "as currently baselined";
- Continuation of projects with either augmentations or reductions to the current baseline;
- Validation of, or recommended changes to, the proposed definition of core data products for each mission;
- Project termination;

(5) Provide preliminary assessments and findings equivalent to (1) through (4) for FY2014 and FY2015.

Extended Mission Scope:

ESD's priority for extended missions is the continuation of quality standard data products which have been demonstrated to be relevant and valuable to the NASA Earth science objectives as stated in the 2010 SMD Science Plan.

Proposals should focus on describing and justifying the minimum resources and activities required to continue the basic mission – that is, mission operations and routine production and delivery of core standard data products. The *core standard data products* are verified products routinely produced by the mission Science Team or the Distributed Active Archive Centers, with algorithms maintained by the Science Team members under funding from DA. This definition does not include experimental/research products or standard products with algorithms routinely maintained by ROSES-selected investigators.

Calibration and validation activities for algorithm and product quality maintenance may be included during the extended mission. Compared to the prime mission phase, fewer services should be offered to external data product users during the extended mission, as users are assumed to have become more knowledgeable during the mission's prime and previous extension phases. The basic mission should include the minimum necessary science review and assessment of instrument performance to verify and validate the data products. The proposal should clearly justify the level of science support required to maintain the quality of these core data products.

Compared to the prime mission phase, proposers are encouraged to propose and justify an increased risk of data collection degradation in exchange for an associated reduction in mission cost. Mission operations coverage should provide for the safe management of the aging satellite, but greater allowance for hands-off operation should also be considered. As the basic mission operations and data delivery focus on the continued execution of proven processes, it is expected that a continuous improvement process will result in reductions in the cost of these established activities during the extended mission.

Enhanced or extended data products and science are not solicited through this Senior Review. Proposals for science investigations of this nature are solicited through the ESD Research and Applied Sciences Programs.

Funding Environment:

Missions proposing to the ESD Senior Review will compete for an allocation from a pool of funds comprised primarily of the budgets from all of the missions in extended phase.

Each mission must propose and justify an "in-guide" budget which does not exceed the current NASA operating plan (the "N2" budget) for each year in the period under review. The in-guide budget profile will be provided to each mission team prior to proposal preparation and submission.

Missions may optionally propose and justify an "optimal" budget that could potentially result in benefits such as more efficient future operations, improved data continuity, increased utilization by the research community, and/or increased use by applied and operational users; however, because the pool of funds available to the extended missions is highly constrained, few if any optimal proposals are likely to be accepted.

Instructions to Proposers:

Each mission that is subject to this Senior Review and that is seeking to continue operation shall submit a proposal outlining their mission implementation approach and proposed Project-supported data analysis for the FY2012 – FY2015 period covered by the review. Missions will be approved for 2012 and 2013. Plans and budgets for 2014 and 2015 will be used for out-year planning purposes. The proposals must detail and justify how the project will continue to conduct basic mission operations and to provide core data products that meet ESD, NASA, and national needs.

The proposal shall contain a science section, a technical/budget section, and four required appendices containing a mission data product inventory, budget spreadsheets, references and a list of acronyms. Note that there is NO Education/Public Outreach (E/PO) section; the E/PO plans are to be submitted separately from the mission proposals after the conclusion of the Senior Review.

For all missions except Terra, Aqua, and Aura, the scientific and technical/budget sections should be no more than 30 pages. For Aqua and Aura, the same sections should be no more than 41 pages, and Terra should be no more than 45 pages. All pages are to be on 8.5 inch by 11 inch paper, with character (font) size not less than 10 points. Not included in the page limits are the four required Appendices and a fifth optional Appendix containing technical performance data. The proposal must be submitted in PDF format with the budget spreadsheets in XLS format (see below). (If your institution requires signatures, please place them on one separate submittal letter; copies of this submittal letter will not be used in the peer review but will be retained within the ESD. The project name and names of key authors at the top of the first page will suffice for review purposes.)

Instructions for the Science Section: The science section should comprise approximately two-thirds of the proposal and address four major topics: science merit, data products, applied and operational uses, and programmatic elements

Science Merit: Describe the science merits of your program and the specific contributions of the instruments within your mission. List the current science objectives for the mission and a summary clearly focused on what has been accomplished in the past two years. Explain how the proposed science program contributes to the ESD objectives as stated in the SMD Science Plan.

Data Products: Describe how the mission will continue to produce the core standard data products during the extension, including discussion of any current or predicted instrument or spacecraft performance degradations that affect the quality of those products. Resources required for routine calibration, validation, and algorithm maintenance to maintain the quality of these data products should be included. A list of core standard data products, highlighting changes since the last Senior Review (or since launch for OSTM), should be included in Appendix A.

For core standard data products that rely on data from missions or instruments outside of the proposing project's control, identify the required external resource. If all NASA parties in the shared data product are proposing in response to this letter, each mission should detail its own elements of the task along with the complementary support from the other mission(s).

Applied and Operational Uses: Describe the applied merits of the mission and specific contributions of the instrument and data products to applied and operational uses (i.e. non-research purposes). The proposal should convey the value of datasets for applications that serve national interests (operational uses, public services, military operations, etc). Clearly summarize what has been accomplished in the past two years for applied and operational uses, including technical specifics and well-described examples. Explain how the proposed mission extension contributes to the applications-oriented objectives as stated in the SMD Science Plan.

Programmatic Elements: Briefly summarize the programmatic elements required for mission implementation, including the geographic and organizational locations of key mission elements (science management, project management, ground station, science data acquisition and distribution center, etc.), and

the identification and roles of any international or inter-Agency partners. Also identify any parallel funding sources, such as ROSES, that are ***required*** for supporting any of the activities in these mission extension proposals, both for efforts already funded and for anticipated future funding.

Projects should consider providing an on-line bibliography of recent publications. The proposal should contain the URL/web address to this bibliography. Bibliographies included in the text of the proposal will be counted against the page limit.

Instructions for the Technical/Budget Section: This section should be approximately one-third of the proposal and address two major topics: technical status and a budget narrative.

Technical Status: Discuss the overall technical status of the components of the mission. Include the spacecraft, instruments, and ground systems including spacecraft control center and science center(s). Summarize actions taken to improve the effectiveness of the mission operations tasks and describe what improvements have been accomplished. Summarize the health of the components and point out limitations as a result of degradation, aging, use of consumables, obsolescence, failures, etc. Proposers are encouraged to provide supporting data in the form of engineering data tables and figures in the optional Appendix E. Include an estimate and rationale of mission life expectancy. Although the proposal need not include an End of Mission section, an update to the approved End of Mission Plan will be required, as per NPR 8715.6A, as part of the post-Senior Review response.

Budget Narrative: ***The budgets proposed in the Senior Review must be fully consistent with the budgets submitted in the parallel Program Planning & Budget Execution (PPBE) 2013 process.*** Labor, major equipment and other expenses for both the in-guideline scenario and the optimal scenario must be explained in sufficient detail to determine the incremental cost of each proposed task. The budget must include all project-specific costs including mission services performed by the ESMO at GSFC, at JPL, by NASA's networks such as the Ground Network (GN), the Space Network (SN), or the NASA Integrated Network Services (NISN).

Summarize anticipated 'in kind' support from NASA-funded sources other than the project's MO&DA budget. These 'in kind' sources include but are not limited to: processing of mission data to generate core data products; satellite tracking support from NASA networks; and support from the multi-mission infrastructure projects at GSFC, JPL, and elsewhere. Supporting or in-kind sources that should NOT be included in the budget tables: parallel algorithm development activities funded through ROSES; airborne science infrastructure; supporting activities from non-NASA sources such an international partners, other US Government agencies. However, the extent of the partners' participation and their funded technical and programmatic contributions should be identified in the narrative.

Attachment A to this letter contains the Work Breakdown Structure and definitions for "MO" and "DA." Attachment B contains instructions and the mandatory form for the budget portion of each proposal. This form will serve as the standard budget spreadsheet for all proposals. Each proposal should contain narrative and further details in a format as determined by each project. For the period under consideration in this Senior Review, FY12-FY15, up to two scenarios may be summarized in the mandatory form and described in the technical/budget proposal: an "In-Guideline" Scenario and a "Requested/Optimal" Scenario.

- In-Guideline Scenario: Describe a plan which does not exceed the guideline of the current NASA operating plan (the "N2 budget") in each year. The in-guideline scenario is assumed to be sufficient to achieve the basic mission science objectives, including its contribution to national goals. All efforts must be made to develop a detailed and justified in-guide budget. If the project believes the current budget guideline is insufficient to support the present set of products and activities, the project should identify the set of activities and products that will be supported, and the impacts of any adjustments in work content on the science return for the mission.

- Optimal Scenario: You may describe a funding level that leads to a more effective or efficient mission or improves data continuity/quality, but still recognizes the very tight fiscal constraints that NASA faces. In other words, the optimal scenario should be a carefully considered request, not a maximal request. The technical/science description of this scenario should clearly define the discrete items or activities mapped to the WBS (see Attachment A) and expected benefits compared to the in-guideline scenario. The required budget should include credible cost estimates and bases of estimates phased by year.

The budget spreadsheet provides tables for 'in-kind' support and for instrument team budgets. The format for the tables of in-guideline, optimal, and in-kind budgets all follow the WBS breakdown described in Attachment A. Note that although an E/PO narrative section is not required as part of the Senior Review Proposal, the format includes an E/PO budget as a WBS line item in the budget spreadsheets. You should plan to reserve approximately 1-2% of your total budget for E/PO activities.

An updated proposal for efficiency metrics will not be required in the proposal phase, but will be requested as part of your response to the Senior Review decisions, anticipated summer 2011.

Required Appendices: Four appendices are required and do not count against the page limit:

Appendix A: Mission Data Product Inventory. Include a brief (no more than 100 words per product suggested) summary description of the data product; the approximate time duration of the data record; the instrument(s) required to produce the product; the maturity of the algorithm(s) required to produce the product; the primary NASA and/or applied and operational users (including contact information such as phone or e-mail addresses, if known); and the availability and location of the product for community use and access.

Appendix B: Mission budget in specified format. Attachment B describes the mandatory format for your budget request and supplies a spreadsheet template. Supplementary, detailed cost information to assist the cost evaluation is encouraged, and does not count against the page limit.

Appendix C: Acronym list

Appendix D: References actually cited in the text of the proposal.

Appendix E: Engineering trend data to support the spacecraft and/or instrument projected performance and life expectancy. This appendix is optional and does not count against the page limit.

Proposal Submission:
Proposals must be uploaded electronically in PDF format to a NASA HQ Scienceworks website (https://scienceworks.hq.nasa.gov/) and must be received by 6:00 PM EST on March 4, 2011. Simultaneously, each project must upload their budget spreadsheets and supplemental cost data in XLS format. The budget spreadsheets should not be incorporated into the proposal document but should be uploaded as separate files.

Senior Review Panel meetings:
The Technical & Cost and National Interests panels will meet at least two weeks before the Senior Review Science Panel to permit their findings to be available to the Science Panel. The National Interests panel will meet at the same time as the Technical & Cost panel. These panels will provide a set of questions for further clarification from each mission and submit the questions to the Science Panel for their consideration to ask the project teams.

The Senior Review Science panel will meet twice, once to discuss the proposals and develop questions for the mission teams to answer during the presentations, and again to meet with the mission teams, discuss their evaluations and develop findings.

1st Meeting (April 15):

Morning: Instructions, Operating Missions background, logistics (writing assignments, etc.), discussion of conflicts of interest and procedures to minimize their impacts. Afternoon: Discussion of Proposals & Develop Questions for the Projects.

2nd Meeting (May 3-5):

Day 1: Morning: Review Instructions, Operating Missions background, logistics (writing assignments, etc.) and briefings from the supplementary panels. Afternoon: Project Presentations.

Day 2: Complete Project presentations.

Day 3: The Senior Review panel completes tasks (1) through (5), as described above.

Presentations to the Senior Review panel:
Each proposing project will be allotted time for an oral presentation to the panel, with the time allocation varying depending on the mission size and complexity, with a minimum duration of 30 minutes allotted for any single mission. Two weeks before the presentation, each mission team will be provided a set of questions from the Science Panel and a time allocation. To minimize the burden on projects, no more than three people may represent any one of the missions, or one representative per major instrument on the mission, whichever is greater. During each project presentation, the project representatives should plan on using no more than one-half of the allocated time for their prepared presentation, reserving one-half for additional questions and answers. The prepared presentation should concisely and thoroughly answer the specific questions that the Science Panel provided to the mission team following their initial review.

- The primary purpose of the oral presentations is to provide a forum for questions from panelists and answers from the projects.
- Secondarily, this is an opportunity for projects to provide any significant updates, e.g. changes in technical status since proposal submission.
- Lastly, and with lowest priority, it is an opportunity to repeat highlights of the proposals, which will have been read by all panelists.

After the meeting of the Senior Review panels:
All of the Senior Review panels will produce a report of its findings. The Senior Review Science Panel will provide a mature draft of key findings and conclusions and will brief the ESD Director, prior to completing its deliberations. Within six weeks following the ESD review, the panel will submit its final written report, which incorporates information from the supplementary panels, to the ESD Director. All the panel reports will be posted later to a public NASA HQ web site.[1]

NASA HQ will contact each of the proposing missions/projects and relay the new SMD mission extension decisions resulting from the Senior Review. The decisions will include new budget guidance, if appropriate, programmatic guidance including possibly notices of intent to terminate, and other specific instructions resulting from the Senior Review process. Within four weeks of being informed of the Senior Review decisions, each project must submit back to HQ its plan for complying with the new guidance and instructions, including any documentation updates as required .

Throughout the Senior Review process the HQ program scientists and executives will ensure that key officials in participating international space agencies or other U.S. government agencies that are partners in a proposing mission are kept informed. The HQ program officers will be responsible for apprising our partners of NASA's decisions resulting from the Senior Review.

Schedule for the 2011 Senior Review:
The following is a schedule for the 2011 Senior Review and for the mission extension and planning process for the Earth Science operating missions:

Mission Team Feedback at AGU:	December 15, 2010
Call for Proposals issued:	January 6, 2011
Proposals due:	March 4, 2011
Technical & Cost and National Interests panels	April 11-15, 2011
Senior Review panel meets:	April 15 & May 3-5, 2011
Publication of the panel's report	June 2011
New budget guidelines and instructions to projects:	July 2011
Projects revised implementation plans to ESD	August 2011

Further Information
A resource library website will be established at http://2011ESD_SeniorReview.larc.nasa.gov. Proposers may have requests for clarification on any of the items contained in this letter or on the website. For further information, contact the Senior Review Program Officer, Cheryl Yuhas, at Cheryl.L.Yuhas@nasa.gov, or at the address below. The ESD will review all requests for information and if additional updates are sent out

[1] See for example: http://nasascience.nasa.gov/earth-science/mission_list. Reports from the 2007 & 2009 Senior Review are currently available on this site.

they will be shared with all proposers. It is the sole discretion of the ESD to determine which, if any, clarifications are required.

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Two attachments:

A. Definitions of the Work Breakdown Structure for NASA Science Operating Flight Missions
B. MS Excel spreadsheet: ESD Senior Review FY12-FY15_Std_Spreadsheet.xls

Attachment A: Definitions of Work Breakdown Structure for NASA Science Operating Missions

The WBS elements shown below are intended for flight projects in all phases of implementation, from pre-Phase A through mission termination and disposal. The Projects should use the WBS dictionary for guidance on how to break out their proposed costs, but as general suggestion for missions in operation, and in particular in extended operations beyond the primary mission phase, only a subset of the standard WBS elements are expected to show any activity. Among the eleven level 2 WBS categories identified below, active elements for our missions would reasonably be:

1.0 Project Management
4.0 Science/Data Analysis
7.0 Mission operations
9.0 Ground systems
11.0 Education & Public Outreach

Management of the mission elements could be accounted for in either Project Management (1.0) or Science (4.0), with the projects defining the appropriate distribution in their proposals. Any efforts related to Systems Engineering (2.0), Safety and Mission Assurance (3.0), Payload (5.0) and Spacecraft (6.0) could reasonably be folded into Mission Operations (7.0) for extended missions. Launch vehicles (8.0) and Systems Integration and Testing (10.0) clearly are no longer applicable.

(Taken from the draft NASA Procedural Requirements, NPR 7120.5D, Appendix G)
Standard Level 2 WBS elements for space flight projects are shown in Figure G.4-1. The standard WBS template below assumes a typical spacecraft flight development project with relatively minor ground or mission operations elements. For major launch or mission operations ground development activities which are viewed as projects unto themselves, the WBS may be modified. For example, the spacecraft element may be changed to reflect the ground project major deliverable product (such as a facility). The elements such as payload, launch vehicle/services, ground systems, mission operations system that are not applicable may be deleted.

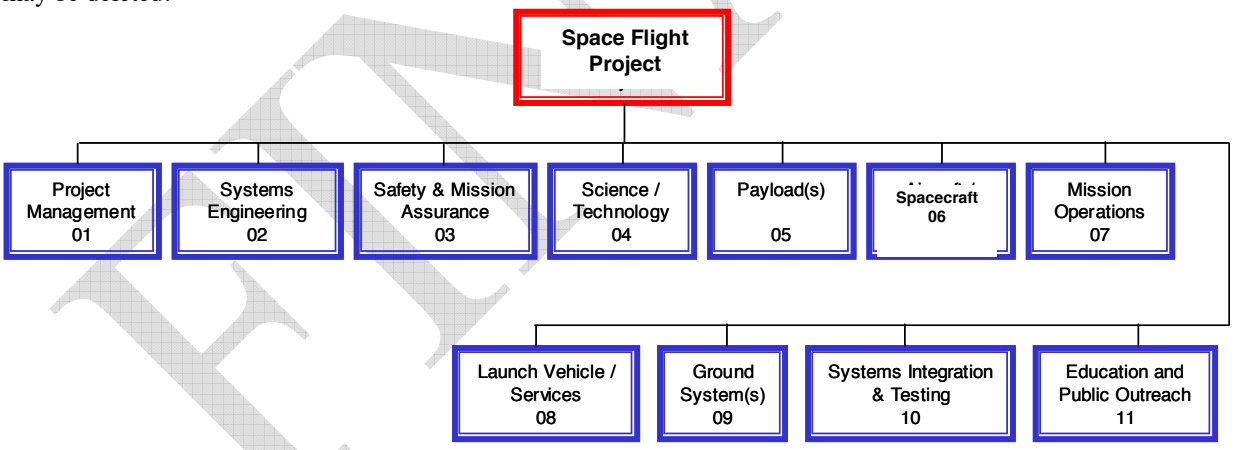

Figure G.4-1 Standard Level 2 WBS Elements for Space Flight Projects

Space Flight Project Standard WBS Dictionary

Element 1 – Project Management: The business and administrative planning, organizing, directing, coordinating, controlling, and approval processes used to accomplish overall Project objectives, which are not associated with specific hardware or software elements. This element includes project reviews and documentation, non-project owned facilities, and project reserves. It excludes costs associated with technical planning and management, and costs associated with delivering specific engineering, hardware and software products.

Element 2 – Systems Engineering: ***[Include in 7.0, Mission Operations.]*** The technical and management efforts of directing and controlling an integrated engineering effort for the project. This element includes the

efforts to define the project space flight vehicle(s) and ground system, conducting trade studies; the integrated planning and control of the technical program efforts of design engineering, software engineering, specialty engineering, system architecture development, and integrated test planning, system requirements writing, configuration control, technical oversight, control and monitoring of the technical program, and risk management activities. Documentation products include requirements documents, interface control documents (ICDs), Risk Management Plan, and master verification and validation (V&V) plan. Excludes any design engineering costs.

Element 3 – Safety and Mission Assurance: ***[Include in 7.0, Mission Operations.]*** The technical and management efforts of directing and controlling the safety and mission assurance elements of the project. This element includes design, development, review, and verification of practices and procedures and mission success criteria intended to assure that the delivered spacecraft, ground systems, mission operations, and payload(s) meet performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts at partners/ subcontractors other than a review/oversight function, and the direct costs of environmental testing.

Element 4 – Science / Technology: This element includes the managing, directing, and controlling of the science investigation aspects, as well as leading, managing, and performing the technology demonstration elements of the Project. The costs incurred to cover the Principal Investigator, Project Scientist, science team members, and equivalent personnel for technology demonstrations are included. Specific responsibilities include defining the science or demonstration requirements; ensuring the integration of these requirements with the payloads, spacecraft, ground systems, mission operations; providing the algorithms for data processing and analyses; and performing data analysis and archiving. This element excludes hardware and software for on-board science investigative instruments / payloads.

Element 5 – Payload: ***[Include in 4.0, Science.]*** This element includes the equipment provided for special purposes in addition to the normal equipment (i.e., GSE) integral to the spacecraft. This includes leading, managing, and implementing the hardware and software payloads that perform the scientific experimental and data gathering functions placed on board the spacecraft, as well as the technology demonstration for the mission.

Element 6 – Spacecraft(s): ***[Include in 7.0, Mission Operations.]*** The spacecraft that serves as the platform for carrying payload(s), instrument(s), humans, and other mission-oriented equipment in space to the mission destination(s) to achieve the mission objectives. The spacecraft may be a single spacecraft or multiple spacecraft/modules (i.e., cruise stage, orbiter, lander, or rover modules). Each spacecraft/module of the system includes the following subsystems as appropriate: Crew, Power, Command & Data Handling, Telecommunications, Mechanical, Thermal, Propulsion, Guidance Navigation and Control, Wiring Harness, and Flight Software. This element also includes all design, development, production, assembly, test efforts and associated GSE to deliver the completed system for integration with the launch vehicle and payload. This element does not include integration and test with payloads and other project systems.

Element 7 - Mission Operations System: The management of the development and implementation of personnel, procedures, documentation and training required to conduct mission operations. This element includes tracking, commanding, receiving/processing telemetry, analyses of system status, trajectory analysis, orbit determination, maneuver analysis, target body orbit/ephemeris updates, and disposal of remaining mission resources at end-of-mission. The same WBS structure is used for Phase E Mission Operation Systems but with inactive elements defined as "not applicable." However, different accounts must be used for Phase E due to NASA cost reporting requirements. This element does not include integration and test with the other project systems.

Element 8 – Launch Vehicle / Services: ***[Not applicable for operating missions.]*** The management and implementation of activities required to place the spacecraft directly into its operational environment, or on a trajectory towards its intended target. This element includes launch vehicle; launch vehicle integration; launch operations; any other associated launch services (frequently includes an upper-stage propulsion system), and associated ground support equipment. This element does not include the integration and test with the other project systems.

Element 9 – Ground System(s): The complex of equipment, hardware, software, networks, and mission-unique facilities required to conduct mission operations of the spacecraft systems and payloads. This complex includes the computers, communications, operating systems, and networking equipment needed to interconnect and host the Mission Operations software. This element includes the design, development, implementation, integration, test and the associated support equipment of the ground system, including the hardware and software needed for processing, archiving and distributing telemetry and radiometric data and for commanding the spacecraft. Also includes the use and maintenance of the project testbeds and project-owned facilities. This element does not include integration and test with the other project systems and conducting mission operations.

Element 10 – Systems Integration and Testing: ***[Not applicable for operating missions, or include in 7.0 Mission Operations.]*** This element includes the hardware, software, procedures and project-owned facilities required to perform the integration and testing of the project's systems, payloads, spacecraft, launch vehicle / services, and mission operations.

Element 11 – Education and Public Outreach: Provide for the education and public outreach (EPO) responsibilities of NASA's missions, projects, and programs in alignment with the SMD Mission EPO Policy. Includes management and coordinated activities relevant to formal education, informal education, and/or public outreach. Periodic support for news media and an education-related web presence is allowable, but should not be the focus of the EPO task. Web site development for project management and coordination is also outside of the scope of EPO.

Additional work element definitions:
"Data Analysis" encompasses the work scope defined in Element 4 above, and specific project-funded data processing of Level 1 and above products. Activities typically included in "Data Analysis" are: customized data processing, analysis activities, documentation, presentation and publication of scientific results, science events planning, instrument and observation performance analysis, science data calibration, validation and certification of processed data, science operations centers, etc. If there are essential data analysis tasks and products currently funded by ROSES elements, the mission team may consider including these activities in the 'optimal' mission proposal.

"Mission Operations" encompasses the work scope defined in Element 7 above, data acquisition and processing through Level 0 only. Activities typically included in "Mission Operations" are: command generation and telemetry monitoring; health and performance monitoring of the spacecraft, instruments, and ground system; mission analysis and planning/scheduling; spacecraft resource (power, etc) constraints analysis; trajectory, orbit, attitude planning and determination, etc.

"Competed Science" encompasses investigations solicited through ROSES.

Attachment B:
MS Excel spreadsheet: ESD Senior Review FY12-FY16_Std_Spreadsheet.xls

	Instructions for the Budget Spreadsheet
General Guidelines	
Show all costs in Real-Year dollars.	
For those missions with budgeted activities at more than one NASA center provide the full cost budget for each Center in both Table I (Budget by Cost Elements/labor, travel and procurements) and Table II (Budget by WBS).	
The approved budgets are for the entire year shown, so if the prime mission ends in the middle of a fiscal year, show the total budget for that year, covering both prime and extended operations.	
The budget totals (all Centers) for the Budget Tables I, II, and III should match, and should equal the top-level approved budget provided on the $K template.	
	Note: Budget totals and breakouts by MO /DA must be consistent with PPBE submission.
Table I	**FY12 - FY16 Approved Budget by Cost Element by Center**
	Separate entries should be made for each supporting Center.
Table II	**FY12- FY16 Approved Budget By WBS By Center**
	Describe how your project's budget breaks down by function, for FY12through FY16.
	The rows in Tables II correspond to the WBS definitions shown in Attachment A to the Call for Proposals.
	Separate entries should be made for each supporting Center.
	Note: WBS 11/Education and Public Outreach amounts by year need to match
	amounts by year to be entered into the Forthcoming Education and Public Outreach
	(E/PO) Call from NASA Headquarters.
Table III	**FY12 - FY16 Approved Budget by Instrument Team**
	Table III is required only for Terra, Aqua and Aura. Other missions should leave this table blank.
	Describe how your budget breaks down by the instrument teams.
	"Other Science teams" may apply to cross instrument science teams and efforts.
	"Other expenses" may apply to shared services such as mission operations, E/PO, Cal/Val, etc..
Note:	Civil servant labor $$ are NOT in the baseline $$, but the FTE info is required in the "Budget
	Template FTE " worksheet.

Project Name:	***Project Name***	***Project WBS***					
Contact Point:		Phone #:					
			FY12	**FY13**	**FY14**	**FY15**	**FY16**
	Approved Budget		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	Total Project Budget Input:		0.0	0.0	0.0	0.0	0.0
DELTA Budget	**Input to Approved Budget:**		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Table I FY10- FY13 Approved Budget by Cost Element and Center							
			FY12	**FY13**	**FY14**	**FY15**	**FY16**
Center:							
	1000 Labor						
	2100 Travel						
	3000 Procurements						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	1000 Labor						
	2100 Travel						
	3000 Procurements						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	1000 Labor						
	2100 Travel						
	3000 Procurements						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	1000 Labor						
	2100 Travel						
	3000 Procurements						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	1000 Labor						
	2100 Travel						
	3000 Procurements						
		Total*	0.0	0.0	0.0	0.0	0.0
TOTAL - Includes all Applicable Centers/Organizations							
	1000 Labor		0.0	0.0	0.0	0.0	0.0
	2100 Travel		0.0	0.0	0.0	0.0	0.0
	3000 Procurements		0.0	0.0	0.0	0.0	0.0
		Total*	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Table II FY10 - FY13 Approved Budget by WBS and Center							
			FY12	**FY13**	**FY14**	**FY15**	**FY16**
Center:							
	4.0 Science						
	7.0 Mission Operations						
	11.0 Education & Public Outreach						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	4.0 Science						
	7.0 Mission Operations						
	11.0 Education & Public Outreach						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	4.0 Science						
	7.0 Mission Operations						
	11.0 Education & Public Outreach						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	4.0 Science						
	7.0 Mission Operations						
	11.0 Education & Public Outreach						
		Total*	0.0	0.0	0.0	0.0	0.0
Center:							
	4.0 Science						
	7.0 Mission Operations						
	11.0 Education & Public Outreach						
		Total*	0.0	0.0	0.0	0.0	0.0
TOTAL - Includes all applicable Centers/Organizations							
	4.0 Science		0.0	0.0	0.0	0.0	0.0
	7.0 Mission Operations		0.0	0.0	0.0	0.0	0.0
	11.0 Education & Public Outreach		0.0	0.0	0.0	0.0	0.0
		Total*	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	* Totals for Table II should be equal to the year by year totals in Table I.						
Table III FY12- FY16 Approved Budget by Instrument Team AQUA, AURA & TERRA Only							
			FY12	**FY13**	**FY14**	**FY15**	**FY16**
	1. Instrument A						
	2. Instrument B						
	3. Instrument C						
	4. etc., (Repeat for all instrument teams)						
	Other science teams						
	Other mission expenses						
		Total*	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	* Totals for Table III should be equal to the year by year totals in Table I.						

Project Name:

Point of Contact:

All entries in Full Time Equivalent (FTE) for Civil Servants, or Work Year Equivalents (WYE) for Contractors

Table I FY10 - FY13 Approved Budget by Cost Element and Center

		FY12	FY13	FY14	FY15	FY16
Center:						
	Civil Service FTEs (9051)					
	On-Site Contractor WYEs (9052)					
	Service Pool FTEs (8021)					
	Total*	0.0	0.0	0.0	0.0	0.0
Center:						
	Civil Service FTEs (9051)					
	On-Site Contractor WYEs (9052)					
	Service Pool FTEs (8021)					
	Total*	0.0	0.0	0.0	0.0	0.0
Center:						
	Civil Service FTEs (9051)					
	On-Site Contractor WYEs (9052)					
	Service Pool FTEs (8021)					
	Total*	0.0	0.0	0.0	0.0	0.0
Center:						
	Civil Service FTEs (9051)					
	On-Site Contractor WYEs (9052)					
	Service Pool FTEs (8021)					
	Total*	0.0	0.0	0.0	0.0	0.0
Center:						
	Civil Service FTEs (9051)					
	On-Site Contractor WYEs (9052)					
	Service Pool FTEs (8021)					
	Total*	0.0	0.0	0.0	0.0	0.0
	TOTAL - Includes all applicable Centers/Organizations					
	Civil Service FTEs (9051)	0.0	0.0	0.0	0.0	0.0
	On-Site Contractor WYEs (9052)	0.0	0.0	0.0	0.0	0.0
	Service Pool FTEs (8021)	0.0	0.0	0.0	0.0	0.0
	Total*	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**